

What is Claimed:

- 1 1. Wireless radiofrequency data communication system comprising:
 - 2 • a base-station comprising multiple first sets and a signal processing-unit, wherein each first
 - 3 set comprises a transmitter- and receiver-unit provided with a transmitter and a receiver and
 - 4 at least one antenna which is connected to the transmitter- and receiver-unit, wherein the
 - 5 signal processing-unit is connected with each of the first sets for processing signals
 - 6 received by the first sets and processing signals to be transmitted by the first sets, and
 - 7 • multiple second sets, wherein each second set comprises a transmitter- and receiver-unit
 - 8 provided with a transmitter and a receiver and at least one antenna which is connected to
 - 9 the transmitter- and receiver-unit, characterised in that, the signal processing-unit comprises
 - 10 information about the transfer-functions of radiofrequency signals from each of the
 - 11 antennas of the first sets to each of the antennas of the second sets and/or vice versa, and
 - 12 wherein the transmitters and receivers, both in the first sets and in the second sets, operate
 - 13 on essentially the same radiofrequency or radiofrequency-band, and wherein the signal
 - 14 processing-unit processes the signals received by the first sets and processes the signals to
 - 15 be transmitted by the first sets on the basis of said transfer functions such that for each
 - 16 second set of a plurality of the second sets an individual communication channel is formed
 - 17 with the base-station wherein these communication channels are generated simultaneously
 - 18 and separately from each other.
- 1 2. Wireless radiofrequency data communication system according to claim 1,
2 characterised in that, the communication channels are duplex communication channels.
- 1 3. Wireless radiofrequency data communication system according to claim 2,
2 characterised in that, the number of first sets is N and, in use, the number of second sets is M,
3 wherein N is greater than M, wherein the signal processing-unit is provided with an inputport
4 for inputting M signals to be received by the respective M second sets, wherein the processing
5 unit is arranged to process the M signals in combination on the basis of the information of the
6 transfer-functions to obtain N transmit-signals which are fed to the respective N first sets for
7 being transmitted by the first sets to the second sets and wherein the processing unit is

8 arranged to process the M signals in combination in such a way that the M signals are received
9 separately by the respective M second sets if the second sets each receive the N transmit-
10 signals, thereby establishing M of said simultaneous communication channels.

1 4. Wireless radiofrequency data communication system according to claim 3,
2 characterised in that, the processing unit is arranged to, in use, process, on the basis of the
3 information about the transfer-functions \mathbf{H} , the M signals \mathbf{Q} to obtain the N transmit-signals
4 \mathbf{R} , to be transmitted by the first sets, according to

$$\mathbf{R} = \mathbf{P}_D \mathbf{Q}, \quad (\text{A})$$

5
6 resulting in that the M signals \mathbf{Q} are received separately by the respective second sets if the
7 second sets each receive the N transmit-signals, where $\mathbf{P}_D = [\mathbf{H}^* (\mathbf{H}^* \mathbf{H})^{-1}]^T$ is the pseudo-
8 inverse for \mathbf{H}^T and where \mathbf{H}^* is the complex conjugated and transposed of \mathbf{H} , wherein \mathbf{H} is a
9 complex $[N * M]$ matrix containing transfer functions h_{ij} ($i=1, \dots, N$; $j=1, \dots, M$), wherein h_{ij} is
10 the transfer function for transmission from the j^{th} second set of the M second sets to the i^{th} first
11 set of the N first sets, and where \mathbf{Q} is a complex M dimensional vector $[Q_1, Q_2, \dots, Q_j, \dots, Q_M]^T$
12 wherein Q_j is the signal to be transmitted to the j^{th} second set of the M second sets and where
13 $\mathbf{R} = [R_1, R_2, \dots, R_i, \dots, R_N]^T$ wherein R_i is the transmit- signal to be transmitted by the i^{th} first set
14 of the N first sets.

1 5. Wireless radiofrequency data communication system according to claim 1,
2 characterised in that,

3 the number of first sets is N and, in use, the number of second sets is M, wherein
4 N is greater than M, wherein, in use, each of the M second sets transmits a signal so that M
5 signals are transmitted to be received in combination by the first sets wherein the signal
6 processing-unit is arranged to process in combination signals received by each of the first sets
7 on the basis of the information about the transfer-functions to recover the M signals
8 transmitted by the M second sets separately from each other, thereby obtaining M of said
9 simultaneous communication channels.

1 6. Wireless radiofrequency data communication system according to claim 5,
2 characterised in that, the processing unit is arranged to, in use, process, on the basis of the

information about the transfer-functions \mathbf{H} , the signals \mathbf{r} which are received by the first sets, to calculate an estimation \mathbf{x}_{est} of the M signals \mathbf{x}^c which were transmitted by the M second sets, according to the mathematical expression

$$\mathbf{x}_{\text{est}} = \mathbf{P}_U \mathbf{r}, \quad (\mathbf{B})$$

where $\mathbf{P}_U = [(\mathbf{H}^* \mathbf{H})^{-1} \mathbf{H}^*]$ is the pseudo-inverse for \mathbf{H} and where \mathbf{H}^* is the complex conjugated and transposed of \mathbf{H} , wherein \mathbf{H} is a complex $[N * M]$ matrix containing transfer functions h_{ij} ($i=1, \dots, N; j=1, \dots, M$), wherein h_{ij} is the transfer function for transmission from the j^{th} second set of the M second sets to the i^{th} first set of the N first sets, \mathbf{r} is a complex N dimensional vector $[r_1, \dots, r_i, \dots, r_N]^T$ with r_i the signal received by the i^{th} first set of the N first sets, \mathbf{x}_{est} is a complex M dimensional vector $[x_{\text{est}1}, \dots, x_{\text{est}j}, \dots, x_{\text{est}M}]^T$ where $x_{\text{est}j}$ is an estimation of x_j^c , and where \mathbf{x}^c is a complex M -dimensional vector $[x_1^c, \dots, x_j^c, \dots, x_M^c]^T$, with x_j^c being the signal transmitted by the j^{th} second set of the M second sets.

7. Wireless radiofrequency data communication system according to claim 6, characterised in that each second set comprises a serial-to-parallel/parallel-to-serial unit, which unit, in use, splits the data signal of said second set in a multiple of signals, and means for modulating these signals on different frequencies according to the Inverse Fast Fourier Transformation, and wherein each first set comprises a unit for executing a Fast Fourier Transformation on the signals received by said first set and means for combining the transformed signals in order to recover said data-signal.

8. Wireless radiofrequency data communication system comprising in use:

- k_1 multiple first groups, wherein each first group comprises a transmitter-unit and at least one antenna which is connected to the transmitter-unit for transmitting a signal; and
- k_2 multiple second groups, wherein each second group comprises a receiver-unit and at least one antenna which is connected to the receiver-unit,

characterised in that, the wireless radiofrequency data communication system further comprises a signal processing-unit which is, if $k_1 > k_2$, connected to each of, the first groups and which is, if $k_1 < k_2$, connected to each of, the second groups, wherein the signal processing-unit comprises information about the transfer-functions of radiofrequency signals

from each of the first groups to each of the second groups and/or vice versa, and wherein, each of the transmitter-units, of the first groups operates on essentially the same radiofrequency or radiofrequency band, and wherein, in use, if $k_1 > k_2$, the signal processing-unit processes k_2 data-signals to be transmitted to the k_2 second groups for obtaining k_1 signals which are supplied to the respective first groups to be transmitted, wherein the k_2 data signals are processed on the basis of said transfer functions in such a manner that the respective second groups will receive separately the respective k_2 data-signals, thereby establishing k_2 simultaneous communication channels, and wherein, in use, if $k_1 < k_2$, the signal processing-unit processes k_2 signals, which are received by the respective second groups on the basis of said transfer functions in such way that an estimation is made of the k_1 signals transmitted by the first groups, thereby establishing k_1 simultaneous communication channels.

9. Wireless radiofrequency data communication system according to claim 8, characterised in that each first group comprises a serial-to-parallel/parallel-to-serial unit, which unit, in use, splits the data signal in a multiple of signals, and means for modulating these signals on different frequencies according to the Inverse Fast Fourier Transformation, and wherein each second group comprises a unit for executing a Fast Fourier Transformation on the signals received by said second group and means for combining the transformed signals in order to recover said data-signal.